AN ANALYSIS OF THE SPECIES OF THE GENUS **CURETIS**, CHIEFLY BASED ON AN EXAMINATION OF THE SPECIMENS IN THE ZOOLOGICAL MUSEUM, TRING.

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(Plates III.—XIX.)

A FEW species of this genus having come into my possession, I found myself considerably puzzled by them. I made some additions to my material and mounted some of the male appendages. The result was to demonstrate that the accepted views (if there are any accepted views) as to species within the genus were in need of being revised.

I obtained the loan, with permission to examine them, of specimens from Mr. Bethune-Baker, and especially from the Tring Museum and from other collections. I herewith present the results.

The Tring material especially is rich enough to have afforded a solution to most of the difficulties that were met with: it especially possesses the Felder types. I had also access, of course, to the types in the British Museum, and was able to verify other specimens with them, so that I did not feel it necessary to desire to dissect any of these.

De Nicéville (1890) regards the Indian species as being only two, and Bingham (1907) accepts this as correct and says, "until extensive breeding experiments are undertaken it will be impossible to attain any certainty as to whether there are two or a dozen distinct forms."

Both authors find the females to afford quite an insoluble problem, even within the Indian area, and de Nicéville says, "The females of both groups" (*bulis* and *thetis*) "appear to be dimorphic, some being white, others ochreous." I think I may say that in the Indian region there are no dimorphic females. Nevertheless I raise a very similar question as regards species in the Pacific region: *thetis* has a white female, yet in the Solomon Islands, a race that is otherwise *thetis* has an ochreous female, with markings different in form to typical *thetis*: are these races of *thetis*, or are they specifically distinct? Again, *tagalica* has an ochreous female, yet in the island of Palawan a form *palawanica* Staud. has a white female, and so was considered a form of *thetis*: are these one or two species? It is to be noticed that the dimorphism (if properly so called) does not occur within any one race, but only as between allied races—a somewhat different problem to that which de Nicéville felt.

Fruhstorfer has a survey of the known species of *Curetis* in the *Stettiner Ent. Zeitung* for 1908, p. 49, which may perchance be of some use in naming specimens. As a discussion of the actual specific value of the various forms very little can be said for it. He quotes de Nicéville's *Butterflies of India*, and says he makes no less than thirteen species from only North India and Borma, and that Distant makes five from the Malay Peninsula.

This misrepresents de Nicéville, who distinctly asserts his belief that he is

dealing with only two species, though he records thirteen described forms. Fruhstorfer himself makes five species in all. He is nearly correct as to *bulis* and *acuta*, but his account of the other species is such a remarkable jumble that it seems useless to discuss it.

Though he appears to have a keen scent for local races and varieties, which one sometimes fears is merely a prejudice that every locality has a local race which wants naming, the arrangement of the forms of **Curetis** he recognises under the five species he accepts leaves everything to be desired.

In Moore's (Swinhoe) *Lepidoptera Indica*, vol. viii. p. 239, *thetis* and *phaedrus* are placed as one species, though they are not (the males at any rate) very difficult to distinguish apart from the examination of the appendages. The others are difficult or impossible without such examination: *e.g. gloriosa* and *saronis* are treated as distinct, and *stigmata*, *dentata*, *angulata* and *malayica* are also regarded as distinct species.

The species as decided by the structure of the male appendages fall distinctly into two sections, which correspond with de Nicéville's First group A and Second group B. There is one species, *insularis*, that is in some degree intermediate.

A. The thetis section.

All the species in this section agree in having a harpe apparently soft and clothed with hairs. The aedeagus, besides the eversible vesica, with its rows of cornuti, possesses an apparently separate piece, articulated and movable, close to the extremity. Its movements are, however, restricted, and it is not eversible. For convenience I call it the "shuttle" piece. They generally have beneath a lunulated postdiscal line, never apparently pointing to the apex, nor have they the dark margin of the forewing encroaching on the inner margin.

1. *thetis*. This form ranges from the plains of India to the Solomon Islands (and farther?), and has many forms; opinions may easily vary as to which forms, if any, are "good" species.
   a. *barsine*.
   b. *egena*.
   c. *ribbei*.
   d. *solita*.
   e. *menestratus*.
   f. *fergussoni*.
   g. *bougainvillei* and a good many others named or nameable.
   h. *lucifuga* (?).
2. *phaedrus* (♀ = *aesopus* Fabr.).
   a. *arcuata*.
3. *celebensis*.
   a. *eos* (?).
4. *saronis*.
   a. *gloriosa*.
   b. *nicobarica*.
5. *nesophila*.

6. *tagalica*.
   a. *palawanica*.
   b. *obsoleta* (ab. ?)
   c. *talautensis*.
7. ? *saleyerensis* (♀ only).

Section A may be tabulated by the ♂ appendages:

1. Harpe with lateral (or rather ventral) process, shuttle piece serrated at side of extremity . . . . . 1. *thetis*.
2. Harpe as with a terminal cap, shuttle piece serrated across end 2. *celebensis*.
3. Harpe simple:
   a. Valves very long (3·2 mm. against 2·0 mm. or less), aedeagus very short . . . . . 3. *tagalica*.
   b. Valves very broad but short (beyond harpe) . . 4. *saronis*.
   c. Harpe very short, aedeagus curved, very large shuttle piece 5. *nesophila*.
   d. Extremity of aedeagus highly chitinised, almost bulbous, and ending in a sharp point . . . . . 6. *phaedrus*.

To tabulate Section A by general aspect, etc., is more than difficult. I make the following attempt:

1. Habitat confined to Southern India and Ceylon, copper of pale tint, border very narrow . . . . . 1. *phaedrus*.
2. ♂ with a very distinct discal line on upperside forewing 2. *celebensis*.
3. Underside markings generally filled in with much dark shading 3. *tagalica*.
4. Hardly distinguishable from *tagalica*; the shading beneath is usually less heavy and the lunules between veins 5 and 7 of forewing beneath project less beyond the others. The margin of copper of forewing has a very regular circular curvature . . . . 4. *nesophila*.
5. Postdiscal line always distinct, though it may be faint, lunules between 5 and 7 hardly project beyond others. . . . 5. *saronis*.
6. Postdiscal line, when present, has lunules 5 and 7 of forewing well beyond others, border upperside broad except in S.E. distribution 6. *thetis*.

I am not prepared to tabulate the females. Of most forms the corresponding males and females are fairly well recognised; to this knowledge I only add the recognition of the males of *celebensis* and of *egena*, of which the types are females and hitherto no males belonging to them have been described.

The species *insularis*, which is rather intermediate between the two sections, has the general facies of Section A. The harpe is soft and clothed with hairs as in A, except that the tip is chitinous as in B, and as in B there is no shuttle to the aedeagus. In its general aspect the species has one distinctive mark: the postdiscal line beneath, following the general direction as in Section A, can hardly be said to be at all lunulated, but rather follows one continuous curve, though curved, one may say a straight line rather than one broken into a succession of lunules.

In the appendages it is also distinct from all the other species in the dorsal hooks being short and square-ended.

B. The bulis section.

Characterised by having the harpe smooth and hard.

The black border usually returns along the inner margin (except in forms *felderi* and *santana*) of forewing.

The underside markings, instead of being parallel to hindmargin, are diagonal, pointing to apex of forewing (except in *sperthis*).

This is the Section B of de Nicéville. It may be tabulated :

1. Aedeagus about or over 2·6 mm. to 2·9 mm. in length,
   bulis, with races
   a. *felderi*.
   b. *santana*.
2. Aedeagus about 2·0 mm. in length,
   a. with square end, *acuta*.
   b. with pointed end, *sperthis*.

The species as decided by the ♂ appendages appear to be as follows :

1. *bulis* with various named subspecies.
   a. *discalis*.
   b. *stigmata*.
   c. a race occurring with *angulata* and hardly separable except by appendages.
   d. *malayica*.
   e. *felderi*.
   f. *santana*.
2. *acuta*.
   a. *dentata*.
   b. *truncata*.
   c. *angulata*.
   d. *paracuta*.
   e. ,, *brunnea*.
3. *sperthis*.
   a. *minima*.

The underside of *sperthis* brings it into relation rather with the *thetis* than the *bulis* section, but the upperside and the ♂ appendages indicate that its proper position is rather with *bulis*.

The underside markings of *bulis* and *acuta* differ as shown in figs. 1 and 2, but there are specimens that it would be difficult to place by this character.

Another very distinctive character is that the pale patches in the female are brown in *bulis*, white (or faintly bluish) in *acuta* ; one item no doubt leading de Nicéville to consider the females in this genus were dimorphic in this respect. Another, to be referred to later, was no doubt the brown female of *gloriosa* (*saronis*), supposed to be a form of *thetis*.

How far the conclusions thus summarised are sound must be judged from the

detailed facts on which I have reached them, and which are given under each species.

In most cases I have no doubt that they are correct, the genitalia of the males being in each species very definite and easily recognised from those of other species. Nor do I myself entertain much doubt in the remaining cases, involving for the most part the difficult questions as to subspecies and geographical races, but I fully recognise that a considerably wider research is necessary to arrive at any result that may be accepted as founded not on some definite facts but on a sufficient number and variety of them, of which the breeding experiments that de Nicéville desired would be a very important section.

Such doubts as I have refer in some degree to the forms of *bulis*, and more particularly to those of *thetis*. Especially in the case of *C. thetis*, the general facies and the genitalia vary together, giving local forms that may be regarded as distinct or as geographical races. There is just sufficient gradation in the forms as one leaves India with typical *thetis* and goes southward and eastward, though the gradation is not very regular, to make one feel satisfied that there is only one species, though of course on the other hand there may be a score or possibly a hundred or more.

The belief that there is only one species commends itself most to me. Such questions must always arise in cases of closely allied forms, and one must recognise that until abundant breeding experiments with the allied forms are made, one's conclusions are, so far as they are crisp and definite, more a matter of faith and prejudice than of sound scientific appreciation.

1. Curetis thetis Drury.

Figs. 8, 9, Bornean example, under- and upperside.
„ 14, 15, var. *bougainvillei* ♂ upper- and underside.
„ 17, 18, „ „ ♀ „ „ „
„ 20, 21, „ *egena* ♂, upper- and underside.
„ 22, 25, „ *fergussoni* ♂, upper- and underside.
Appendages fig. 53. Indian form.
„ „ 54. Ceram „
„ „ 55. British New Guinea.
„ „ 56. var. *barsine*.
„ „ 57. „ *menestratus*.
„ „ 58. „ *fergussoni*.
„ „ 59. „ *bougainvillei*.
„ „ 60. „ *egena*.
„ „ 61. „ *ribbei*.

thetis Drury, *Ill. Ex. Ent.* ii. (1773) p. 16, pl. ix. figs. 3 and 4, ♀.

I am not prepared to assert that Drury's figures represent the species we accept as *thetis*, or whether they may not be *phaedrus*; the locality (Bombay) almost points to the latter, but it is probable that Bombay is rather the place of exportation than the locality of capture.

However, it has been agreed, apparently *nemine contradicente*, even by those who regard them as forms of one species, that the broad-bordered Indian form shall be *thetis* and the narrow-bordered one *phaedrus*, though it is quite possible that Drury's insect was really *phaedrus*.

I accept as *thetis* all those forms whose male appendages are, if not quite identical, still very nearly so, and differ abundantly from those of the forms I regard as distinct species.

With this definition, *thetis* has a very wide range, and a good deal of variety in several respects; and until the evidence of the genitalia appears, these forms seem in some cases to be more entitled to be accepted as distinct species than others that really are so, but have been by various authorities lumped with *thetis*.

C. thetis has usually a fairly broad dark border and large dark tip, whilst *phaedrus* has usually a comparatively very narrow border and tip, and the red colour is paler and yellower, or if not so in the field more readily becomes so in the cabinet.

On the underside both are given to be pure white with so little black marking that not much can be made of it. In better-marked specimens, however, there is a very marked distinction: in *phaedrus* the postdiscal line on both wings is fairly straight and regular, whilst in *thetis* it has a separate curve in each space, and varies in distance from the base, as it does in many other species; for comparison with *phaedrus* it may be sufficient to note that the line on each side of vein 5 of hindwing is markedly advanced to the margin.

In *Iris* xii. p. 247 (1899), Ribbe has some remarks on *solita* of Butler and *thetis* generally, that one must agree with. He says he has a specimen from New Pommern and one from Bougainville which he believes to be *solita*. He says the *Curetis* from the neighbouring regions are so much alike, that it is extremely difficult to distinguish between them. Dr. Pagenstecher, he says, desires to lump, but he would rather separate them; as for instance *thetis* Drury has females with white patches, *barsine* Felder with golden, and *solita* with nearly obsolete golden patches.

When one has examined the appendages of a number of these forms, much the same considerations hold. All these species (that is all I regard as being in this group), which I have examined, have appendages that agree very closely with those of *thetis*.

They all have the shuttle piece in the aedeagus of much the same form. The chief differences are in the harpes. In what I assume to be *thetis* (Drury) the harpe has at about 0·15 mm. from its extremity a projection or flap on the margin next the valve, giving it in fact two extremities, one direct, one lateral. In the forms of *thetis* from these islands, there seems to be considerable variation in these two extremities, which gradually approach each other, culminating in a broad and thickened end such as characterises *ribbei*.

It must be largely a matter of personal equation how many of these forms are held distinct and how many are geographical races of one species. Whilst the data are in so many directions defective we cannot answer the question which are distinct species? but only the more vague one, which shall we assume to be distinct species? In the Solomon Islands we have the females with brown, not white patches; we may assume this to be a good specific character, or minimise it as a kind of dimorphism. In *ribbei*, that seems distinct, the ♀♀ have all the appearance of fine large *thetis*. I should incline myself to call them all geographical races, and to expect to find a slightly different race on fairly separated islands or groups of islands, and with a sufficient series of such races to find a large amount of grading between the different forms. No doubt each

separate form might receive a varietal name. *C. solita* of Butler would be one of these. The form from Fergusson Island is very distinct, so that I venture to give it a name, and that from Bougainville Island is a very marked form with a very distinct female, and should be named; the others of this group have not come before me in more than odd specimens, which it is unsatisfactory to deal with, beyond placing them as representing races of *thetis*.

In dealing with *thetis* I speak of "forms of *thetis*." In doing so it is necessary to explain that I use the phrase in what may be called a new sense in this connection, but in reality in its ordinary and proper acceptance.

I begin by clearing the conception of *thetis* of all the species that used to be included in such a phrase as "forms of *thetis*," but which are all very distinct and definite species, such as *phaedrus*, *gloriosa*, *palawanica*, etc., and include only such forms as occur in various of the insular portions of its range, and as to which questions may be raised both on the superficial appearance and on the structure of the genitalia whether they are simply *thetis*, or are geographical races deserving of a name, or even have diverged far enough to be established species. *barsine* is perhaps as good an example of such a "form of *thetis*" as can be quoted, as it has for long had a recognised name. The Tring collection affords several marked examples of such forms, and also others probably equally definite were there more material. It is highly probable that no small proportion of the Pacific islands, from Sumatra to the Solomon Islands or even farther, have each a race of *thetis*, more or less possible to differentiate from others. I propose to deal only with those that are adequately represented in the Tring collection.

The males vary, especially in the width and proportions of the black border and of the invasion of the copper by dark shading. The appendages differ in the variations of the harpe elsewhere referred to. In the Solomon Islands, the ♀♀ have not white but brown (yellow?) patches, yet these forms have the more ordinary form of harpe. A Bornean form, on the other hand, has an extremely condensed one.

barsine Felder, *Sitzungsber. Kais. Akad. Wiss.* Wien, xl. (1860) p. 451; id., *Reise Novara, Lep.* p. 220 (1865) tab. xxviii. fig. 16. 17 (Amboina).

Has some claim to be regarded as a "good" species, but it may perhaps equally justly be held to be a geographical race of *thetis*.

The genitalia are almost identical with Indian *thetis*.

The type and other Felderian specimens are in the Tring collection.

egena Felder, *Reise Novara, Lep.* p. 222 (1865) (no figure).

The type specimen, a ♀, of this species is in the Tring collection from Halmahera (Gilolo). There are identical specimens from Batchian (= Batjan) collected by Doherty. One of these has a trace of white patches. These Batchian ♀♀ are almost certainly those corresponding to some males with identical locality labels. These males are very remarkable; they are, both on the upper- and undersides, very similar indeed to *tagalica* from Celebes. There are thus in Celebes and Batchian, taken together (probably also in other Moluccan Islands) three very distinct species of *Curetis*—viz. *egena* (*thetis*), *tagalica*, and *celebensis*—that have, in the males at least, a nearly identical facies which is not the usual one of *tagalica* (in other districts) or of *thetis*.

I may say that till I examined the appendages of these insects, I was a good deal puzzled by them, and was inclined to regard them all as *celebensis*,

and that probably as a variety of *tagalica*. I may add that *nesophila* is also very close to these three species in appearance, but by the appendages is very distinct.

C. thetis ♂ is characterised by having the underside markings obsolete, or nearly so, though occasional specimens and some races show them in some degree. *C. egena* has these markings nearly as pronounced as in *nesophila* or *celebensis*, with some trace of the dark shading of *tagalica*. In the postdiscal line the curve across vein 1 of the forewing is much more prominent towards the hind-margin than in the other species. One curious point that makes these specimens approach *celebensis* and leads them right away from the usual form of *thetis*,* is that towards the apex of the forewing the copper colour is divided by the veins as in that species ; the black border is reduced all round more like *phaedrus* than *thetis*, really like *celebensis*.

The appendages are nearly as in ordinary *thetis*, but the branches of the harpe are a little approximated.

There is a specimen from Little Key that is apparently identical with *egena* ; this is no doubt the form called *eberalda* by Fruhstorfer.

Two examples from Waigen, possibly the *gelinthias* of Fruhstorfer, have slightly wider borders, the apical portion of copper distinctly notched, almost divided, the underside markings almost faint ; appendages as *egena*.

fergussoni nov. var.

There are two specimens from Fergusson Island (eastern end of New Guinea) that have a remarkable form hardly suggesting *thetis*, but the appendages are almost identical with those of the (continental ?) New Guinea form *menestratus*, in the two branches of the harpe almost coalescing. Yet on close comparison it really agrees to a great extent with *menestratus*. The dark shading of the bases of the wings and of the inner side of the hindwing is rather greater and has a greater intensity and different character given it by the veins, especially of the hindwings, being much more outlined in black ; indeed this feature is trifling in *menestratus*. The underside markings are the same ; the ground colour is pure white.

solita Butler, *Ann. Nat. Hist.* (5). x. p. 149 (1882) (New Britain).

A ♂ specimen from Herbertshöhe, Neu Pommern (New Britain), is probably the ♂ of this species (the type is a ♀). It has all the appearance of *thetis* ; it differs from *bougainvillei* in possessing a definite (though small) discal mark, and no detached pear-shaped marks. In a series it is very possible that it would prove that the two forms are more identical than they at present appear to be.

The appendages are nearly normal *thetis*.

bougainvillei nov. var.

Very close to a ♂ supposed to be *solita* (from Neu Pommern), but is without the discal mark of that insect, and has, which *solita* (?) wants, the pear-shaped costal detached portions of copper as in *celebensis* ; the lateral process of the harpe is rather smaller than in *solita*, but both are very close to typical *thetis*. Expanse 46 mm. The females are large (44 mm.), very dark in colour, with

* Found also in var. *menestratus* and a few other forms.

a moderate-sized rather pale brown patch on forewing; none on hindwing, except a trace in one specimen. Bougainville Island, 12 ♂♂, 5 ♀♀, in Tring collection.

menestratus Fruhst., *Stett. Ent. Zeit.* 1908, p. 50.

This seems to be the form in Dutch New Guinea. It has very broad black borders of fairly uniform width (except, of course, at apex), the pattern almost suggesting *Colias edusa* ♂, and there is considerable dark shading basally. The ♀ is very much like typical *thetis*, the appendages showing the branches of the harpe nearly fused (as in *ribbei*).

In British New Guinea the females are much the same, but in the males the borders are narrower, and in the appendages the branches of the harpe are separate, nearly as in typical *thetis*. The undersides are well marked in both forms, and are sometimes white, sometimes creamy—the former more frequent in the Dutch section, the yellowish in the British.

ribbei Röber, *Iris* i. p. 70. pl. v. figs. 2 and 3 (1886).

Well figured, though without colour. This form has perhaps diverged sufficiently from typical *thetis* to be a "good" species. It is small, very pale, and with a very narrow margin. The ♀ is exceedingly like that of *thetis*; it is larger than the ♂. Both sexes have the pure white underside of *thetis*; the chief difference from *thetis* in the ♂ appendages is in a tendency to approximation and fusion of the two branches of the harpe, in which it is very close to the New Guinea forms, though the superficial appearance is so different; the harpes are rather long and straight as compared with typical *thetis*; the aedeagus is almost typical *thetis*. Aru Islands.

lucifuga Fruhst., *Soc. Ent.* 1909, p. 121.

"*lucifuga* is probably the *thetis* form of the island." Formosa.
No figure.
I have not seen this.

2. **Curetis phaedrus** Fabr.

Fig. 7. Underside.
Appendages. Figs. 62, 63, 64, 78.

phaedrus Fabr., *Spec. Ins.* ii. p. 125. n. 566 (1781); Hübn., *Ex. Schm.* pl. 237. fig. 263, 264, underside (poor); Cramer, iii. pl. ccxxxviii. fig. c.

The aedeagus in *phaedrus* is very characteristic, and is distinguishable from that of any other species at first glance. The extremity is a conspicuous black mass, a little pear-shaped, and with a projecting point carrying a small spine or two.

The harpe is soft, clothed with hairs much like the valve, from which it is separate for only a short way.

aesopus Fabr., *Spec. Ins.* p. 125. n. 565 (1781); Distant, *Rhop. Mal.* Tab. xxiv. fig. 12 ♂. xliv. fig. 14 ♀.

The type specimen is a ♀, and Mr. Distant's comparison of his specimens with this may or may not be accepted.

My own examination of the type specimen leads me strongly to believe that they (there are two of them) are ♀♀ of *phaedrus*; so far as their collocation in the

Banksian collection goes, Fabricius' treatment of them and the assignment to them of the same locality, vague as it is, all go to suggest that the specimen of *phaedrus*, placed close to them in the Banksian collection and described by Fabricius under the following number, really came from the same place, and are ♂ and ♀ of the same species. Fabricius quotes Drury's figure of *thetis* as being the same insect. He quotes it, by the way, as *thetys*, a circumstance that accounts for the confused variation in the spelling of the name, which is common; Drury, however, says *thetis*.

The ♀ ♀ of *thetis* and *phaedrus* are so much alike that neither de Nicéville nor Bingham attempt to discriminate between them; they both, in fact, accept the two species in both sexes to be identical. They are, however, quite distinct; but, omitting this fact for the moment, I fully accept Bingham's conclusion as to *aesopus*, that it "falls as a synonym of *C. thetis*,* as acknowledged by Fabricius himself. The type, a ♀, is in the Banksian collection now in the British Museum, and is undoubtedly a ♀ of ordinary *C. thetis*, Drury."

I have examined a good many specimens claiming to be *aesopus*, and nearly all of these prove to be *bulis*, but I have two specimens whose ♂ appendages agree precisely with those of *C. sperthis* (*q.v.*).

arcuata Moore, *Proc. Zool. Soc. Lond.* 1883. p. 523. Pl. xlviii. fig. 3 (Malabar).

The figure and description agree with a specimen labelled "*Curetis arcuata* Moore," "Malabar," from the Moore collection, and apparently in Moore's writing. This specimen is *phaedrus*.

Unauthenticated specimens sent me as *arcuata* from Nias are forms of *bulis*.

C. phaedrus seems to have a comparatively restricted range, the extreme South of India, Balai, "Malabar," Ceylon, Bombay, Barrackpore. So far as I know, *phaedrus* is the only *Curetis* occurring in Ceylon; but it is surely highly probable that *thetis* occurs there also.

What any particular records mean is of course doubtful, so long as *phaedrus* and *thetis* are more or less confounded. On the other hand, the *thetis* of Moore's *Lepidoptera of Ceylon* is no doubt *phaedrus*.

3. Curetis celebensis Felder.

Figs. 23 and 24. Male, upper- and underside.

Appendages. Fig. 68.

celebensis Felder, *Reise Novara, Lep.* p. 220. Tab. xxviii. fig. 14, 15 (1865).

The figures are of the ♀ upper- and undersides, and agree exactly with the specimens. The reduction of the rusty marks on upperside to somewhat linear marks on the forewing, and tendency to divide that on hindwing into two portions, is characteristic.

There seems to be no figure of the male, and this sex does not appear to have been known to Felder. There are, however, in the Tring collection several males, collected by Doherty in South Celebes in August and September 1891.

The South Celebes specimens in the Tring Museum belonging to this species and to *C. tagalica* form a remarkable group. The two species are so much alike that in both sexes the distinction is at first sight difficult. Both seem to have been taken by Doherty at the same time and place. In the males in both species

* *thetis* and *phaedrus* being in Bingham's view synonyms.

the veins run some little way into the wing as black lines from the black border. This black border and the outline of the wings is fairly identical in the two species, and it is to be remarked that in both, the dark veins cut off two or three small pear-shaped portions opposite the middle of the costa. Opposite the middle of the hindmargin of the forewing the sections of copper between the veins are rounded or convex in *celebensis* and somewhat concave in *tagalica*. In *celebensis* there is also a dark (discal) line down the discocellular nervure. I have called this form of *tagalica* var. *dohertyi*.

On the underside the specimens of *tagalica* have a good deal of the dark clouding that so often characterises that species. This is almost absent in *celebensis*. In *celebensis* the sections of the postdiscal line are more convex than in *tagalica*, in one specimen only the one descending to vein 1v on both wings, instead of curving inwards as in other specimens and as in *tagalica*, continues obliquely outwards and meets vein 1v much nearer the hindmargin than when the line continues on the other side of the vein.

The Appendages. The aedeagus is just over 2 mm. long. It much resembles that of *thetis* : the loose terminal plate is very large ; there is an ordinary-looking series of cornuti. The hooks of the tegumen have their tips bent sharply round into a hook. The harpe is largely free from the valve, is clothed sparsely with hairs, and has the appearance of having a chitinous cap, overhanging towards the valve.

C. thetis var. *egena* (*q.v.*) is also a member of this mimetic group.

eos Röber, *Iris* i. p. 198. pl. vii. fig. 9 (1887).

I have not seen a specimen of this variety. The description and figure are of a ♀ specimen, and I have not met with any account of the male. The figure seems to be a very good one, except that, being photographic, the rusty areas are not shown. The underside markings leave little doubt that it is identical with *celebensis* Felder. The only difference is that it is a very small specimen—32 mm. against 40 mm. and upwards.

4. **Curetis saronis** Moore.

Fig. 19. Male, underside.
Appendages. Fig. 65. *saronis* (Andamans).
,, ,, 66. ,, var. *nicobarica* (Nicobars).
,, ,, 67. ,, ,, *gloriosa* (Rangoon).

saronis Moore, *Proc. Zool. Soc. Lond.* 1877. p. 587 (S. Andamans).
gloriosa Moore, *l.c.* 1883. p. 522. pl. xlviii. fig. 1. ♂.
nicobarica Swinhoe, *Ann. Mag. N. H.* (6). v. p. 451 (1890).

These three forms are one species : *gloriosa* is a continental race of large size, *saronis* is a smaller insular form. Of *nicobarica* I have not yet been able to obtain a specimen that did not prove on dissection to be *saronis*.

Referring to Col. Swinhoe a question as to a specimen I had as *nicobarica*, he informed me that the specimen came from the Andamans and was *saronis*, and that at one time specimens in his collection were marked *nicobarica* = *saronis*. He now differentiates *nicobarica* from *saronis* by the females—" the female of *nicobarica* is a brown insect, the female of this insect has white patches in the middle of the wings." To this I may say, however, that I have an Andaman female that has no white patches, and that ♀ *nicobarica* in the Tring and in my collection have the

outer corner of the pale patch of the hindwing white. These differences are very short of possessing specific value ; the ♂♂ are indistinguishable either by wings or genitalia.

I had not noticed till after I had decided that *gloriosa* was a form of *saronis*, that Moore describes the female as having "forewing with broad golden yellow discal area, hindwing with a narrow curved discal streak." This confirms, had it been necessary, its relationship to *saronis*, and shows it to be unrelated to Indian *thetis*.

I have a specimen of *gloriosa* from the Moore collection that is interesting in two points : in the first place (labelled Sylhet) it is only 42 mm. in expanse against 52 mm. *gloriosa*, thus showing the difference in size between *gloriosa* and *saronis* to be of no specific value. It has the postdiscal lines beneath arched as in typical *gloriosa* ; in *saronis* they are much straighter, but certainly variable, as I have a *nicobarica* almost identical in this (and other) respects with this small *gloriosa*. The other point of interest about this specimen is that it has attached to it a memorandum by Moore. "*Anops*. Sylhet x—near to *insularis* (Java), smaller, f.w. shorter, the red area smaller, rounded opposite the apex, the brown border of exterior margin much broader at the posterior end ; h.w. with comparatively broader brown marginal border, the red area suffused with brown on abdominal border ; underside greyish white, with blnish grey discal lunular band and submarginal lunular line. The discocellular streak, basal spots and inner margin of the lunular bands dark speckled. Hab. Sylhet. Coll. F. M."

The appendages of *saronis* are very distinct ; the aedeagus is 1·9 mm. long, of *thetis* type, with movable accessory smaller than in *thetis*, the extremity less strongly chitinised than in *thetis* ; the cornuti are very abundant, small, and very regularly arranged in ribbon form.

The most characteristic feature is the short, very broad valves, with a short harpe, conjoined to them more closely, or rather free from them for a much shorter distance than in any other species except *nesophila*, in which the outline both of valve and harpe is very different.

The distribution of the species would seem to be from Sylhet, by Rangoon, and the chain of Nicobars and Andamans to Sumatra, avoiding the Malay Peninsula.

5. **Curetis nesophila** Felder.

Fig. 10. Male, upperside.
„ 28. „ underside.
Appendages. Figs. 71, 72.

nesophila Felder, *Wien. Ent. Monats.* 1862. p. 289. Figured in Semper's *Philippinen*, pl. xxxi. fig. 28, 29, p. 158.

I find it very difficult to define this species by the general facies. Nor, indeed, am I quite confident that the species I am dealing with is the one described as *nesophila*. Nevertheless, by a process of exclusion, I conclude I am right, as the specimens accord with no other species, nor are there other specimens that can possibly be *nesophila*.

Semper's description of the black margin of the forewing having its inner margin circularly curved, is the best and most easily seized character I can find to distinguish it from other species and especially from *tagalica*.

The species is very much like *tagalica*, differing chiefly in being less clouded and by the dark shading on the underside.

The appendages are easily recognised; the aedeagus is short (1·7 mm.), and has a marked curvature, the only species with this character; the loose shuttle piece is very long (0·65 mm.), but is possibly attached at its near extremity; the cornuti are small, and not very numerous. The valves have beyond the harpes parallel sides (for 1·3 mm.) and rounded ends. The harpes are free for a very short distance, and are so short that their free portion is triangular.

Fruhstorfer calls this species *insularis*: see remarks under that species.

There are specimens of *nesophila* from Penang and from Borneo.

6. **Curetis tagalica** Felder.

Figs. 26, 27, var. *dohertyi* (S. Celebes).
„ 11, 12, 13, 16, var. *talautensis*.
Appendages. Fig. 73. (Kalim Bungo).
„ „ 74. Sent me as *insularis*.
„ „ 75.
„ „ 76. var. *palawanica*.
„ „ 77. „ *talautensis*.

tagalica Felder, *Wien. Ent. Monats.* vi. p. 289 (1862) (Luzon); id., *Reise Novara, Lep.* p. 221. tab. xxviii. fig. 19, 20 (1865).
thetys var. *palawanica* Staud., *Iris* 1889. p. 121.
obsoleta Felder, *Wien. Ent. Monats.* 1862. p. 289.

C. tagalica appears to be a rather widespread species and has many varieties, some of very large size, some very small, some with very wide black borders, some with them very reduced, some in which the copper colour is very coppery, almost red, others in which it is pale, almost golden. The species with which it is most likely to be confounded are *celebensis*, *nesophila*, and *egena*. It may generally be recognised, at least in the ♂, by the large amount of dark shading on the underside, especially along the basal side of the postdiscal line.

The ♂ appendages are most characteristic, and are recognisable without a lens; they have the longest valves and the smallest aedeagus of any species. The remarkable circumstance that the males of *tagalica* and the form *palawanica* are indistinguishable both in facies and as to the appendages, whilst the ♀♀ have brown patches in *tagalica* and white in *palawanica*, shows that this colour variation has not such specific value in this genus as has been supposed, and in this case represents a dimorphism of the ♀ similar to that which occurs in other Lepidoptera.

There is another similar case in the genus: *C. thetis* has a ♀ with white patches, but the form of *thetis* from Bougainville, in the Solomon Islands, and from other localities in its south-eastern distribution, has a very different ♀ with brown patches, and these are of a different outline—so that, though the ♂ has not diverged from *thetis* more than would amount to a geographical race, the ♀ has diverged beyond what that aspect usually covers.

In the case of *palawanica* the divergence has not gone so far, and may be covered under some hypothesis suggestive of dimorphism, such as I have referred to.

palawanica is a variety not of *thetis* but of *tagalica*; that Staudinger placed it as a variety of *thetis* was possibly due to his regarding *tagalica* as a variety of

thetis, but more probably to the fact that *palawanica* has a ♀ with white patches, whilst they are brown in *tagalica*. I have seen no white females of any other race.

palawanica ♂ is smaller than the largest *tagalica*, is of a rather paler copper, and has very narrow black borders; the underside is not often as dark as in *tagalica*, and may be quite pale; the markings are identical.

In the absence of specimens of the female it is impossible to say whether males more like *palawanica* than like typical *tagalica* belong to one form or the other.

In the Tring collection there are specimens (4) from Sula Mongola, which on personal appearance one would call *palawanica* without doubt, but which, looking to the habitat, are almost certainly *tagalica*.

The Felder specimens of *tagalica* include the type (Manilla) and eleven other specimens—4 ♂♂, 7 ♀♀—from Celebes, Luzon, and Borneo. From Sumatra there are 3 ♂♂ of a rather small form with the black border wide, with 3 ♀♀ apparently belonging to them, though not collected at same time and place. From South Celebes are 4 ♂♂ and one very large (50 mm.) ♀, and 2 ♂♂ from Dongola. From Mindoro 4 ♂♂, 3 ♀♀ (46 mm.) of average appearance; there is a fifth ♂ from Mindoro that differs from the others only in being small (37 mm.), and which agrees very closely with a specimen in the Felder collection that I take to be the type of *obsoleta*, though it is not so marked. This Felder specimen is labelled, however, Luzon, and *obsoleta* is said to come from Mindanao. All these localities are Philippine, but of course the labelling of the supposed type of *obsoleta* is rather against its being so. On the other hand, if this is not the type, where is it? It agrees well enough with the description, and is a very small specimen (36 mm.). Felder notes that *obsoleta* is the smallest species of the genus that he knows, and that it is very close to *tagalica*. The specimen is in poor condition, and is one of the most mended of the Felder examples. Bungao provides two rather small (42 mm.) ♂♂ of somewhat Palawanic facies; 2 ♂♂ from Bunguran have rather wider borders to the hindwing than usual, and 1 ♀. There is 1 ♂ from Manilla (much smaller than type specimen), 6 ♂♂ and 2 ♀♀ from Nias, 1 ♂ and 1 ♀ from Borneo.

dohertyi nov. var., South Celebes, mimics *celebensis*.

This form is referred to under *celebensis* and *thetis*, var. *egena* (*q.v.*).

obsoleta Felder, *Wien. Ent. Monats.* 1862. p. 289 (Mindanao).

Specimen (much mended) in Tring collection seems to agree with description. It has all the appearance of being a very dwarf specimen of *tagalica*. Though it has no label to that effect, it is with the highest probability the type specimen of *C. obsoleta* Felder.

talautensis nov. var.

There are four specimens from the Talaut Islands, which I refer to *tagalica* as a variety, though they might claim specific rank.

They look very different from any other form of *tagalica* known to me, and only on examining the appendages are they seen to be very close to, if not identical with, that species.

The ♂ has a black border very wide at the apex of the upper wing, and it maintains its width down the hindmargin much more than in *tagalica*, but the width of the border of the hindwing is much as in *tagalica*. From these margins the

veins are marked inwards by black lines in a way that there is sometimes a trace of in *tagalica*, but is here very marked, and between these lines the copper is dusted with dark scales so as to give a heavy dark rich appearance, assisted by the darkness and brilliance of the copper and by dark shading from the base; in this respect there is no form of *tagalica* that approaches it. There is further a definite difference of wing-form: the apex of the forewing and the anal angle of the hindwing are both produced, so as to be obviously in contrast with *tagalica*. The underside has much the same lines as *tagalica*, but the appearance is very different, as the whole underside has the silvery whiteness of *thetis* with no dark shading, only the fine lines and marginal dots.

In the ♀ the upperside rusty markings are more reduced than any specimen (♀) of *tagalica*, though one approaches it; the underside presents no appreciable difference.

The appendages are but slightly different; the aedeagus is 2·1 mm. long (in *tagalica* 1·8 mm.), and the harpes are distinctly narrower.

7. **Curetis saleyerensis** nov. spec. ?

Fig. 29. Upper surface, ♀.
„ 30. Underside, ♀.

There are two ♀♀ specimens from Saleyer Island (just south of Celebes), unfortunately unaccompanied by males; these are very unlike any other species I have seen, but belong, judging from the underside markings, to the *tagalica* section. It seems desirable to give them a name, provisionally, *saleyerensis*.

8. **Curetis insularis** Horsf.

Appendages. Figs. 69, 70 (N.E. Sumatra).

insularis, Horsf. *Cat. Lep. E.I.C.* p. 125. n. 52 (1829); id. and Moore, *Cat. Lep. Mus. E.I.C.* vol. i. p. 53. t. 1 a. fig. 14 (upperside); Distant, *Rhop. Malay.* Tab. xli. fig. 6, 7, ♂ ♀ (upper- and underside).

This is a very well-defined species, not likely to be confounded with any other. The figure of the underside in Distant's *Rhop. Malay.* is very good. The distinguishing character is that the postdiscal line beneath is very smooth and regular, with hardly any or very slight undulations. There seems to be nothing in the assertion that the ground colour is of a creamy tint: some specimens are so, but some are quite white. The statement probably arises from the circumstance that *saronis* has some resemblance beneath to *insularis*, and is usually very white, but the real distinction is that *saronis* is less distinctly marked and the postdiscal line is undulated.

The male appendages are equally distinctive: the dorsal hooks have the appearance of being broken off instead of being long, sweeping and pointed; they are rather short, taper very little if at all, and end in a square blunt tip.

The harpes have a lateral process very much like *thetis*, and the extreme end of the straight piece is smooth and chitinous; this, together with the *sperthis*-like aedeagus, in which the shuttle piece does not seem detached from the rest of the tube, indicates an alliance with the *bulis* section.

The specimens in the Tring Museum came from Sumatra, Java, Malay Peninsula, Banka, etc.

Fruhstorfer (*Stett. Ent. Zeit.* 1908, p. 53) calls this species "a ♀ forma *pseudinsularis* nova (= *insularis* Dist. nec Horsfield)," and I received from Staudinger, apparently in accordance with this, specimens of *insularis* labelled "*pseudinsularis*," and of *nesophila* labelled "*insularis*."

How this curious assertion arises I do not know ; Staudinger's *pseudinsularis* is certainly identical with the Horsfield type in the British Museum, as it is identical with specimens I have compared with the type, and I accept Distant's figures as fairly good of the species, which is so distinct in its underside markings that it can hardly be confused with anything else.

Fruhstorfer makes this statement so categorically that one supposes he has examined Horsfield's type ; if so, some mistake must have arisen in the notes taken, or in some other way. I have not studied Fruhstorfer's paper closely enough to say that there are no other faulty identifications, but that is my impression.

The localities of the specimens at Tring are N.E. Sumatra, 7 ♂♂, 3 ♀♀ ; W. Sumatra, 2 ♂♂ ; Sumatra, 2 ♂♂ ; Mt. Tahan (Mal. Pen.), 2 ♂♂ ; Selangor, 1 ♀ ; Banka, 5 ♂♂, 5 ♀♀ ; Java (Felder coll.), 1 ♂ ; Borneo, 1 ♂.

9. **Curetis bulis** Doubleday and Westwood.

Fig. 5. Underside, ♂.
Appendages. Fig. 31. Clasps.
„ „ 32. Aedeagus.
„ „ 33. var. *malayica*.
„ „ 34. from Borneo.
„ „ 35. labelled *angulata*.
„ „ 36. from Sikkim.
„ „ 37. var. *santana* (N. Borneo).
„ „ 38. „ „ (Pahang).
„ „ 39. „ *felderi* (Borneo).
„ „ 40. „ „ (Coll. Bethune-Baker).

bulis Doubleday and Westwood, *Genera Diurn. Lep.* ii. p. 473, pl. 75, fig. 5 (1852).

This species has had attributed to it portions, and indeed the whole of the following species, *acuta*.

The ♂ appendages at once distinguish them; the size and form of the aedeagus differ so as to be at once recognisable, and appear to be quite constant in the very considerable number of specimens that I have examined of each species ; that is, the extreme variations in each species still leave a marked gap between them at their nearest approach to each other.

There are various named forms of *bulis*, such as *discalis* Moore, *stigmata* Moore, *malayica* Felder, to which I add *santana* Horsf. & Moore, and *felderi* Distant, though these require a little more discussion.

angulata Moore is no doubt a form of *acuta*, but it so happens that there is a very similar form of *bulis*, and these two (both of which occur in collections under the name *angulata*) come from the same region (N.W. Himalayas), whether from the same localities or not I do not know, but this area is the extreme northern range of *bulis* and the extreme western of *acuta*.

In this, as in the other species and forms, I depend rather on the photographs than on description to convey the characters of the appendages; in *bulis* I note that the cornuti are very numerous and rather small, the aedeagus 2·6–3·0 mm. long, with a terminal form and armament that is very distinctive. The harpe is smooth, solid, sometimes rather pointed, more often rounded at the tip, rarely in some races inclined to broaden out. The valve is rather long and narrow, as in the species of this B section.

Unauthenticated specimens labelled *arcuata* Moore from Nias, but really *bulis*, have the harpes rather more blunt.

A specimen labelled *malayica* (in Moore's writing) from Burmah has the harpe rather sharp.

malayica Felder, *Reise Novara, Lep.* p. 221. Tab. xxviii. fig. 18 (1865); Distant, *Rhop. Malay.* p. 202. Tab. xxii. fig. 28 ♂ (1884).

The type specimen of *malayica* agrees with specimens I have examined, obtained from various quarters; these all prove to be forms of *bulis*.

Specimens of *bulis* from Penang and Province Wellesley have a very close resemblance on the upper surface to *acuta*; they are nevertheless *bulis*.

santana Horsf. and Moore, *Cat. Lep. Mus. E.I.C.* p. 54. n. 97. 1857. refer to Boisd., *Sp. Gén. Lép.* 1. Tab. 23. fig. 1. (1836).

This name has puzzled me a good deal: two examples so named from the Moore collection proved both by wing markings and genitalia to be *sperthis*; they both hailed from Java, and are no doubt the same as Standinger's *javana* (see *sperthis*). Boisduval's figure is of the male upper surface, and might be *thetis* or various other species.

There is, however, in the Tring collection a specimen labelled *santana* that probably represents the name correctly; it is from the Felder collection, and has labels "Java cll. de Capellen." "Santana, Moore, Java, v. d. Cap."

I happen to possess a similar specimen, but from Borneo, at least as labelled. On the upper surface these are not at all unlike *thetis*, but there are one or two points, such as the produced anal angle of the hindwing, that receive their explanation when it is seen that the underside is that of *bulis*. Both these specimens have appendages the same as those of *bulis*.

It appears, then, that *santana* is a Javan race of *C. bulis*, in which the black border is not returned along the inner margin, a feature that characterises *bulis* almost everywhere else, but the extent of which is so variable that such a form as *santana* only carries this variation a trifle farther than usual. If my specimen is correctly labelled, which I doubt (it is from the Moore collection), this form also occurs in Borneo.

There are two specimens, one (No. 4) from the Straits Settlements, that has a certain amount of black along inner margin, and one (No. 20), purely *santana* in marking, from N. Borneo, that both show the enlarged harpe of *santana*.

felderi Distant, *Rhop. Malayana*, p. 203. Tab. xxiv. fig. 3. ♂ xxii. fig. 26 ♀ (1884).

Mr. Distant writes me that he believes the type specimen is in the Zoological Museum at Tring. I have seen only one specimen, not labelled "type," but "Felderi, Dist." apparently in Mr. Distant's writing, and a locality label "Sing

Ken" or something like that. This specimen belongs to the species I have called and believe to be "*nesophila*." The underside of *nesophila* is quite unlike that figured in *Rhop. Malay.* as *felderi*, so that if this is the type specimen it is lucky it is not so labelled; the upperside agrees well enough with the figure of *felderi*.

The underside figure of the male is clearly of the *bulis* group, a little blurred or rubbed, that of the female is highly suggestive of *nesophila*.

There is in Mr. Bethune-Baker's collection a specimen labelled "Felderi" that agrees well enough with the figure (♂) in *Rhop. Malay.* This specimen, however, is not Malayan, but comes from Sandakan, Borneo; this is not, of course, decisive against its being *felderi*.

My information, then, allows me (1) to leave the species alone, (2) to sink it as a synonym of *nesophila* (*nesophila* in the Tring collection is Malayan and Bornean), (3) to accept provisionally the Bakerian specimen as authentic. I adopt the latter course as more likely to advance knowledge, even if itself an error—as it proposes as *felderi* a form with strong claim to be a "good" species, but more especially because I believe it more nearly represents the fact.

This same locality produces ordinary *bulis* and also *sperthis*.

I conclude, in fact, that Mr. Distant had what I accept as *felderi*—namely, that of which he figures the male underside, and which is represented in Mr. Bethune-Baker's collection under the name *felderi*; he had also, and mixed with them, specimens of what I accept as *nesophila*. Of these he figured a female, and labelled as *felderi* the male in the Tring Museum.

felderi on this assumption is a subspecies (or distinct species) of *C. bulis*, differing from the usual form in having the black margins as in *santana* or *thetis*—i.e. narrowing to anal angle of forewing, and not extending at all along the inner margin. In this respect it does not differ from the form *santana*, of which I have a Bornean specimen.

The genitalia, however, of this specimen of *felderi* differ from ordinary (and usual Bornean) specimens of *bulis* by the dorsal hooks being shorter and blunter, and by the harpes being expanded to a blunt square tip. A variation of this sort is common in *C. acuta*, but the only specimen of *bulis* in which I have found it is another Bornean specimen—and in a minor degree a *bulis* (from Sikkim) and a *discalis*. This difference in the genitalia might give this *felderi* some claim to be a "good" species.

My numerous preparations of the ♂ appendages of *bulis* do not present a complete series in this matter of the harpe, from one extreme form to the other, but in view of the considerable variation in specimens from each locality, and that I have some localities poorly and many not represented, I conclude that a sufficient number of specimens would show the range of variation to be continuous.

Some few specimens present the discal mark that is more characteristic of the *dentata* form of *acuta*, but the range of variation on the upper surface covers nearly all the ground that de Nicéville assigns to the whole group, and it must be agreed that the upper surface at least gives no certain characters by which to separate *bulis* from the other species of the section.

C. bulis has a rather wide range: N.W. Himalayas (where it imitates the form *angulata* of *acuta*), Sikkim, S. Burmah, Malacca, Penang, Banka, Sumatra, Nias, N. Borneo.

10. **Curetis acuta** Moore.

Fig. 6. Underside, ♂.
Appendages. Fig. 41. var. *angulata* (Buxar).
„ „ 42. „ „ (Kangra).
„ „ 43.
„ „ 44. Burmah.
„ „ 45. „ *dentata*.
„ „ 46. „ „
„ „ 47. „ *paracuta* (Formosa).
„ „ 48. „ *paracuta brunnea*.

acuta Moore, *Ann. Mag. N. H.* (4) xx. 50–51 (1877) (Shanghai); Pryer, *Rhop. Nihon.*, pl. iv. fig. 1 and 2. ♂ and ♀ (both surfaces).
dentata Moore, *Proc. Zool. Soc. Lond.* 1879, p. 137; 1882, p. 244.
truncata Moore, *Ann. Mag. N. H.* (4) xx. 50–51, ♀ (1877). [This seems to be a form of *acuta*. I have had no ♂ to examine.]
paracuta Nicév. = *acuta* Pryer *nec* Moore, *Journ. Bomb. N. H. Soc.* xiv. p. 248 (1902).

De Nicéville says *acuta* Moore = *truncata* Moore = *angulata* Moore. But *paracuta*, though it looks very different from *acuta*, agrees with that species as to the appendages, and must be regarded as the geographical race of that species inhabiting China, Formosa and Japan rather than as a distinct species.

angulata Moore, *Proc. Zool. Soc. Lond.* 1883, p. 522 pl. xlviii. fig. 2 (an angulated form of *bulis* much resembles and passes for *angulata*).

My own specimens of "*angulata*" from several sources all prove to be *bulis*; they were named no doubt from the form of the wings, and these angulated specimens of *bulis* are very similar indeed to true *angulata*, which, from its habitat (N.W. Himalayas) and its having a ♀ with white patches, is no doubt a form not of *bulis*, but of *acuta*.

acuta var. *brunnea* Wileman, *Annot. Zool. Jap.* vii. p. 88 (1909).

I do not know whether this is a distinct race of *paracuta*, or is aberrational.

In the preparation (and photograph) the aedeagus has unfortunately got crushed towards the extremity.

I should define

acuta: 1. Stigmatal mark distinct.
2. Harpe expanded at tip.
paracuta: 1. Stigmatal mark lost in the black area beyond it.
2. Harpe pointed at tip.

I see no objection to any one regarding these as good species, though I think it seems better to consider them geographical races of one species.

C. acuta differs from *bulis* in being usually provided with the dark tooth (*dentata*, *stigmata*) or stigma projecting from the costal dark border into the copper area. The *angulata* form of *bulis* is as angulated as any *acuta*, but *acuta* is usually angulated, *bulis* round-winged. On the underside, the oblique postdiscal line, which in these two species is more or less straight, in the *thetis* section lunulated, is comparatively, at its lower termination, decidedly farther from the

hind-margin (figs. 5 and 6) than in *bulis*. The varied intensity of the markings and the great range in wing form do not make this always self-evident.

The appendages differ from those of *bulis* chiefly in the aedeagus, which is 2·0 to 2·2 mm. long (*bulis*, 3·0 mm.), straight, and somewhat expanded towards its distal extremity. The actual extremity is much narrower than in *bulis*, almost pointed, and therefore carries only a few spines, which are more numerous down the margin.

The harpe varies as in *bulis*; in the *paracuta* form it is generally rather sharp; in the Indian forms it is blunt, and may be broad and tending to duplication at the end.

This is the only definite character in the appendages by which I could define *paracuta* from *acuta*, and the variation in *acuta* in this matter is so considerable that it does not seem to be a satisfactory character for the purpose.

The distribution of *acuta* seems to be North-West India, Nepal, Darjeeling, Burmah, Hainan, Upper Meku, Tenasserim; of *paracuta*, Japan, Formosa, China.

The pale patches in ♀ *acuta* are white, with a bluish aspect most pronounced in *paracuta*; in *bulis* ♀ they are brown.

11. **Curetis sperthis** Felder.

Fig. 1. Underside ♂.
„ 2. Upperside ♂.
„ 3. var. *minima*. Upperside.
„ 4. „ „ Underside.
Appendages. Fig. 49. Sent me as *santana*.
„ „ 50. „ „ *javana*.
„ „ 51. „ „ *santana* (Sandakan, Borneo).
„ „ 52. var. *minima*.

sperthis, Felder, *Reise Novara, Lep.* p. 222 (1865).
aesopus, auct. pars, nec Fabr. (see discussion under *phaedrus*).
Curetis minima, Distant and Pryer, *Ann. Mag. N. H.* (5). xix. p. 265 (1887). Description agrees with specimen in Tring collection labelled "*minima* D. and P." "North Borneo"—which is either a type or a paratype.

Comparing these specimens with the type of *sperthis*, and accepting a specimen in the Tring collection which agrees absolutely with the type specimen for the examination of the appendages, shows all these named forms to be one species.

The figure of a male in Distant's *Rhop. Malay.* pl. xxiv. fig. 12 (called *aesopus*) is apparently the species under review, presenting—what is a characteristic of the species—the abundant irroration of the underside with black points, though the fasciae are rather too much in the *bulis* pattern.

The ♀ of *aesopus* is possibly that species (viz. *phaedrus*), but has nothing in that case to do with *sperthis* (*l.c.* pl. xxiv. fig. 12), nor probably does pl. xxii. fig. 27 represent the ♀ of *sperthis*, though so named.

I have not with certainty recognised the ♀ of *sperthis*. *C. sperthis* is a smaller insect than *bulis* or *acuta*, and in the form *minima* is the smallest form of *Curetis*. It may be distinguished from *bulis* and *acuta* by the underside band being rather of the lunulated *thetis* type, than of that of *bulis*, and by the underside being more frequently thickly irrorated with fine black points.* These are seen in the

* The black irroration beneath is a character of the *B.* (*bulis*) section; it is more frequently present in *sperthis* than in the other species, but it may be absent in *sperthis*, and is often present in *bulis* and still more in some forms of *acuta*.

photographs, figs. 4 and 5. Fig. 2, *acuta*, has a very similar appearance, but here the dots are damages to the specimens, much more visible to the camera than to the unaided eye.

The extent to which the black border invades the inner margin of the wing varies a good deal.

The appendages are on the same type as *bulis*; they may be at once distinguished by the aedeagus being much shorter (2·0 mm.); the extremity, instead of being square, has a pointed trowel-shaped form, and so looks much narrower; and instead of the long compound double row of very numerous small cornuti, it has only a few of comparatively very large size.

There are specimens of *sperthis* from Malacca, N.E. Sumatra, Java, and Borneo.

In mounting the abdomina of ♂ specimens of *Curetis* my attention was at once attracted by the existence of a fan on the basal abdominal segment, which I found in all the examples of the genus in which I looked for it. It is very similar to the fan that exists in Sphinges, and still more like that found in some Noctuae. I am not aware that a similar abdominal fan has hitherto been described in any butterfly. The fan consists of a large pencil of hairs arising from a special area on the lower posterior angle of the dorsal plate of the second abdominal segment. The hairs are rather more than 2·0 mm. long. No doubt, in use, they are spread and displayed and probably diffuse a scent, but I have not met with any record of their having been observed. At rest, they lie closely together in a special pocket, which crosses obliquely the sternite of the third abdominal segment and encroaches on the fourth. The precise disposition of the pockets will perhaps be better gathered from figs. 78 (× 8), 79 and 80 (× 15). In fig. 80, though all the hairs are in the pocket, a number have been torn away from their point of origin. Fig. 83 shows the hairs and their origin (× 25). Fig. 82 is similar, a number of the hairs have been lost, but one side of the pocket separated from its attachments is seen.

The scale sockets of the area about the pocket present the usual vase-like or dumb-bell outline (fig. 84, × 300); passing from these to the pocket, they gradually change their form, until in the pocket itself they have a flask-like, nearly globular form, and give rise not to scales, but to short tapering hairs (fig. 85, × 300).

It would seem that the sockets have been modified into scent glands, with a certain capacity to accommodate an accumulation of the scent material, and that the fine hairs served to conduct it to the hairs of the fan when about to be expanded.

The hairs of the fan have no spicules, but are very straight and simple, yet when highly magnified, have a spongy, corky look, not the smooth, polished surface of most insect hairs, so that one supposes them to be somewhat spongy in order to absorb a supply of scent.

The well-known scent-fans of Sphinges much resemble these fans of *Curetis*, but their disposition differs somewhat; the fan or pencil of hairs in Sphinges arises from the same segment, the second abdominal, not however from the tergite, but from the middle of the dorsal margin of the sternite; the pocket in which it rests is merely the fold of membrane between the dorsal and ventral plates.

In a Noctua (an American Acontian is figured) the fan arises from the first abdominal sternite, and occupies a pocket almost identical in appearance with that in *Curetis*; the difference from *Curetis* is in the point of origin of the fan and in the pocket being longitudinal instead of oblique; a photograph of a portion of this preparation is shown in fig. 81.

EXPLANATIONS OF PLATES III.—XIX.

Figures 1 to 30 are the upper- and undersides of certain species, to show points of resemblance or distinction between them which are not well or not at all illustrated by figures already published.

They are enlarged something less than two diameters, generally as about 11, 12, or 13 to 7 ; and are from photographs by A. E. Tonge.

Figures 31 to 77 are photographs of ♂ genitalia, also by Mr. Tonge, and are magnified by 25 diameters.

Figures 78 to 85 illustrate the scent fans or pencils ; these are by Mr. F. N. Clark.

I do not present any figures of the female genitalia. These appear to present items for specific characters in the structures of the eighth abdominal sternite, but the preparations I have made and had photographed refer to species whose distinctive characters are otherwise adequate, or to specimens whose determinations I am not sufficiently sure of to rely on them ; these remain therefore for some future occasion, and I expect for some other observer.

Imagines.

Figs. 1 and 2. *sperthis* ♂, under- and upperside.

„ 3 and 4. „ var. *minima*, upper- and underside.

Note the numerous minute black dots on the underside, which are characteristic of the species. Fig. 6 appears to show similar dots, but in this figure these are blemishes of the specimen hardly visible to the naked eye, but picked up, as the figure shows, by the camera; in figs. 1 and 4 they are actual markings.

Fig. 5. *bulis* ♂ underside.

„ 6. *acuta* ♂ „

These show the different position of the oblique postdiscal line in the two species, especially how much nearer the base of the wing it is on the inner margin in *acuta*. Unfortunately both species vary so much in wing outline that it is often difficult to verify this difference.

Fig. 7. *phaedrus* ♂, underside, shows the postdiscal line faintly.

Figs. 8 and 9. *thetis* ♂ under- and uppersides. British North Borneo form.

A comparison of 7 and 8 shows that the advance towards the hind-margin of the lunulated line forward of vein 4, which obtains in various species, is absent in *phaedrus*, but marked in *thetis*. *C. thetis* from India is usually too devoid of markings to illustrate this.

Fig. 10. *nesophila*, upperside, shows the regular arch-like curve of the outer margin of the copper area, which is approached, but not so definite in other forms of *Curetis*, fig. 28, underside.

Figs. 11 and 12. *tagalica* var. *talautensis* ♂, upper- and undersides differ from the type form in the outline of the copper area and in the paleness of the underside.

Figs. 13 and 16. *tagalica* var. *talautensis* ♀, under- and uppersides ; this differs less than the ♂ from the typical form.

Figs. 14 and 15. *thetis* var. *bougainvillei* ♂, under- and upperside.

„ 17 and 18. „ „ „ ♀, upper- and undersides. The figures sufficiently show the differences from typical (Indian) *thetis*.

Fig. 16. *talautensis*. See fig. 13.

Fig. 19. *saronis* ♂, underside; beneath the upper wing the postdiscal line approaches the straightness that it has in *phaedrus*.

Figs. 20 and 21. *thetis* var. *egena* ♂, upper- and underside.

Note the mimetism between figs. 20, 23, and 26; 20 does not resemble typical *thetis*, nor 26 typical *tagalica*, as regards the uppersides, but beneath they agree well with those species, which the genitalia show them to belong to.

Figs. 22, 25. *thetis* var. *fergussoni* ♂, upper- and underside.

This has the wedge-shaped portions on the costal margin of the copper of upper wing, characteristic of other South-Eastern races of *thetis*, and found in *celebensis* and *tagalica* var. *dohertyi*.

Figs. 23, 24. *celebensis* ♂, upper- and underside.

„ 26, 27. *tagalica* var. *dohertyi* ♂, upper- and underside.

„ 28. *nesophila* ♂, underside (and fig. 10).

„ 29, 30. *saleyerensis* ♀, upper- and underside.

Appendages.

Fig. 31. *bulis*, clasps.

These can be exhibited in this way only by separating them from the other parts; this gives a better idea of their structure than the other photographs, from specimens mounted to show (so far as may be) all the parts, and demonstrate specific differences.

Fig. 32. *bulis*, aedeagus.

Its characteristic form is equally evident in the four following figures.

Fig. 33. *bulis* var. *malayica*.

„ 34. „ (Borneo).

This is from the same specimen as fig. 5; on the upperside the black margin returning along the inner margin is little more than a line along vein 1, a close approach to var. *santana*.

Fig. 35. *bulis* (labelled *angulata*).

„ 36. „ a Sikkim specimen, shows thickening of ends of harpe approaching var. *santana*.

Fig. 37. *bulis* var. *santana* (North Borneo).

„ 38. „ „ „ (Pahang, Malay Pen.).

These show expansion of the end of the harpe unlike typical *bulis*; but fig 38 is not very different from fig. 36, and I have other similar specimens. The curve in the aedeagus in fig. 37 is due to a bend (in preparation) of which an indentation on its left side may be seen.

Fig. 39. *bulis* var. *felderi* (Borneo).

„ 40. „ „ „ (coll. Bethune-Baker).

Hardly differ from 37 and 38; in fig. 40 undue parsimony in amputating the abdominal extremity left behind portions of the aedeagus and saccus.

Fig. 41. *acuta* var. *angulata* (Bnxar).

„ 42. „ (Kangra).

„ 43. „

„ 44. „ (Burmah).

Attempts to mount the whole appendages in figs. 42 and 43 (as in fig. 31) are not very successful.

These figures show well the short, wide, urceolate aedeagus and the variability of the harpes.

Figs. 45 and 46. *acuta* var. *dentata*.

Fig. 47. *acuta* var. *paracuta* (Formosa).

„ 48. „ „ „ ab. *brunnea* (coll. Bethune-Baker).

In the last preparation, the aedeagus has unfortunately been crushed (in preparing, probably).

All these are within the limits of variation shown in a number of preparations of *acuta*, of which figs. 41–44 are a sample; in fig. 48 the dorsal hooks are longer and more slender than usual, and 47 and 48 are altogether larger, especially in the tegmen.

Fig. 49. *sperthis* sent me as *santana*.

„ 50. „ „ „ *javana*.

„ 51. „ „ „ *santana* (Sandakan, Borneo).

„ 52. „ var. *minima*.

The aedeagus is shorter than in *acuta*, narrower, and has a characteristic pointed extremity.

Fig. 53. *thetis* India.

„ 54. „ Ceram (sent me as *phaedrus*).

„ 55. „ British New Guinea.

„ 56. „ var. *barsine* (coll. Bethune-Baker).

All these show the "shuttle" piece fairly well, 53 and 55 especially show the position of the serrations it carries.

Fig. 57. *thetis* var. *menestratus* Fruhst.

„ 58. „ „ *fergussoni*.

Both these show the tendency to fusion of the two lobes of the harpe, giving some resemblance to the peculiar caplike end in *celebensis*.

Fig. 59. *thetis* var. *bougainvillei*.

„ 60. „ „ *egena*.

These two are more like typical *thetis*; in one harpe of 59, and both of 60, the lateral lobe is folded over so as to be not so easily seen.

Fig. 61. *thetis* var. *ribbei*.

The aedeagus is typical of *thetis*, the harpes are rather lengthened for *thetis*, but the differences can hardly be said to be beyond those of geographical races.

Fig. 62. *phaedrus*.

„ 63. „ (Balai, India).

„ 64. „

These show (as compared with *thetis*) the much broader valve, the shorter simple harpe and the heavy extremity of the aedeagus.

Fig. 65. *saronis*, type form from Andamans.

„ 66. „ var. *nicobarica* from Nicobars.

„ 67. „ „ *gloriosa* (Rangoon).

These have a very broad valve, a short harpe, and a rather long shuttle.

Fig. 68. *celebensis*.

Differs from *thetis* in the caplike end of the harpe, and the serrations being at the end of the shuttle, and in minor points, such as the hooked extremity of the dorsal hooks, which are less suddenly curved at the end in *thetis*.

Fig. 69. *insularis*. N.E. Sumatra.

„ 70. „ „ „

The abrupt end of the dorsal hooks is not met with in any other species, the valves are shorter than in *thetis*, the harpes have a side-process very similar to but not identical with those in *thetis*. The shuttle is very weakly chitinised.

Figs. 71 and 72. *nesophila*.

The base of the harpe is wide and cylindrical, the end short, the free portion of the valve straight and cylindrical, the cornuti are few, the shuttle is long; and the most noticeable character, because not occurring in other species, is the curvature of the aedeagus.

Fig. 73. *tagalica* (Kalim Bnngo).
„ 74. „ sent me as *insularis*.
„ 75. „

These are conspicuous at once from their large size (the insect itself is not especially large), and the actually as well as comparatively short and slender aedeagus.

Fig. 76. *tagalica* var. *palawanica*.
„ 77. „ „ *talautensis*.
„ 78. Abdomen of *C. phaedrus* ♂, × 8, shows positions of origin of fan and of pockets.
„ 79. Shows position of fan and pocket on 2nd, 3rd, and 4th abdominal segments. × 15.
„ 80. Another specimen. × 15.
„ 81. A very similar fan and pocket in a Noctua (Acontian), but with quite a different point of origin for the fan. × 20.
„ 82. Fan and portion of pocket. × 25.
„ 83. Fan. × 25.
„ 84. Scale sockets close to pocket. × 300.
„ 85. Modified scale sockets (glands ?) and hairs in the pocket. × 300.

These (84 and 85) merge into each other at the margins of the pocket.